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ABSTRACT

Performance objectives are stated for both of the secondary school units included in this package of instructional guides prepared for the Dade County Florida Quinmester Program. Both units are concerned with astronomy and space: "Our Solar System" and "From Atmosphere to Space." The former deals mainly with astronomy while the latter unit includes some principles of flight, suborbital and orbital. Lists of texts, films, filmstrips, and other instructional aids are included in each unit. A course outline summarizing the content of the units, numerous suggestions for experiments, activities, and projects are given. A master sheet showing the relationship of each suggested activity to the objectives of the package is appended to each booklet. (TS)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

OUR SOLAR SYSTEM

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SCIENCE
(Experimental)

OUR SOLAR SYSTEM

5343.05

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SCIENCE

(Experimental)

Written by Maurine Harrison and
C. K. Worthington

for the

DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida
1971

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OUR SOLAR SYSTEM

COURSE DESCRIPTION

A study of the interaction of the sun, and its family of plants and their moons.

ENROLLMENT GUIDELINES

No prerequisites

STATE ADOPTED TEXTS

1. Brandwein, Paul, Stollberg, Robert, and Burnett, Will. Matter - Its Forms and Changes. New York: Harcourt, Brace and World, Inc., 1968.

2. Brandwein, Paul; Beck, Alfred; Strahlen, Violet; Hollingworth, Leland. The World of Matter-Energy. New York: Harcourt, Brace and World, Inc., 1964.

3. MacCracken, Helen; Decker, Donald; Read, John; and Alton, Yarian. Scientists Solve Problems. 2d ed. Atlanta: The L. W. Singer Company, 1966.

4. Namowitz, Samuel N. and Stone, Donald B. Earth Science- The World We Live In. 3rd ed. Princeton: D. Van Nostrand Company, Inc., 1965.

5. Oxenhorn, Joseph M. Pathways in Science - Man and Energy in Space. New York: Globe Book Company, Inc., 1970.

6. Thurber, Walter A. and Kilburn, Robert E. Exploring Science Eight. Boston: Allyn and Bacon, Inc., 1966.

PERFORMANCE OBJECTIVES

1. The student will identify the relative positions of the following bodies in the universe: planets, solar system, moons, meteors and comets.

2. The student will compute from given data the relative distances of the planets from the sun.

3. The student will distinguish between the planets' periods of revolution and their periods of rotation.

4. The student will differentiate among the nature of forces among the astronomical bodies.

5. The student will describe the sun's size, composition and temperature.

6. The student will investigate the nature of sunspots, solar prominence,and the corona.

7. The student will describe the moon's size, shape, and surface features.

8. The student will describe the following features of the earth: size, shape, motions.

9. The student will compare the moon's and earth's periods of rotation and revolution.

10. The student will devise a method to show the phases of the moon.

11. The student will devise a method of showing how the lunar and the solar eclipse occur.

12. The student will construct a model to show the relative positions of the earth, sun, and moon during high and low tides.

COURSE OUTLINE

I. Solar System

A. The planets and their characteristics
1. Planet names and classifications
a. Inner - all those inside Asteroid Belt
b. Outer - all those outside Asteroid Belt
c. Major - (Giant) planets - Jupiter, Saturn, Uranus, and Neptune.
d. Minor - (Terrestial) Planets - Mercury, Venus, Earth, Mars, and Pluto
2. Periods of revolution
3. Rotation (periods where known)

B. Other members of the sun's family
1. Satellites of the planets
2. The minor planets
3. Comets
4. Meteors and meteorites

C. Planetary motions
1. Law of gravitation
2. Kepler's laws

II. The Sun

A. Physical characteristics
1. Size
2. Composition
3. Temperature
4. Volume

B. Surfaces and atmospheric phenomena
1. Sunspots
a. Cycles
b. Polarity
c. Radiations
d. Effects
e. Flares
2. Prominences
3. Corona

COURSE OUTLINE (CONT'D)

III. The Earth

A. Physical features
1. Size
2. Shape

B. Earth's motion
1. Rotation
2. Revolution
3. Precession

IV. The Moon

A. Physical features
1. Size
2. Shape
3. Surface

B. Motions of the moon
1. Rotation
2. Revolution

C. Phases

V. Interactions of the Sun, Moon and Earth

A. Eclipses

B. Tides

INVESTIGATIONS

Brandwein, Stollberg, and Burnett. Matter - Its Forms and Changes. New York: Harcourt, Brace and World, Inc., 1968.

1. An Apprentice Investigation of a Model of a Planet in Orbit (p. 129)
2. The Size of the Moon (p. 149)

Brandwein, Beck, Strahlen, and Hollingworth, The World of Matter-Energy. New York: Harcourt, Brace and World, Inc., 1964.

3. The Sun's Spectrum (p. 431)

MacCracken, Decker, Read, and Alton. Scientist's Solve Problems. 2d ed. Atlanta: The L. W. Singer Company, 1966.

4. Finding Out Your Weight in Space (p. 252)
5. Comparing Actual and Estimated Weights of Objects (p. 254)

Namowitz and Stone. Earth Science - The World We Live In. 3d ed. Princeton: D. Van Nostrand Company, Inc. 1965.

6. Investigating Kepler's Laws. (p. 364)
7. Make a Model of the Foucault Pendulum. (p. 404)

Oxenhorn, Pathways in Science - Man and Energy in Space New York: Globe Book Company, Inc., 1970.

8. How Can We Show the Earth's Rotation? (p.83)
9. How Can We Draw an Eclipse? (p. 84)
10. What Are the Moon's Motions? (p. 95)
11. How Are Shadows Formed? (p. 108)

Thurber and Kilburn, Exploring Science Eight. Boston: Allyn and Bacon, Inc., 1966.

12. Pendulums (p. 378)
13. Pendulums and the Earth's Shape (p. 380)
14. The Tidal Bulge away from the Moon (p. 377)

INVESTIGATIONS (CONT'D)

Davis, Gross, and Johnson, Science - Discovery and Progress. New York: Holt, Rinehart and Winston, Inc., 1965.

15. Finding the Sizes and Distances of the Planets from the Sun. (p. 327)
16. How Inertia Affects Tides (p. 348)

Wolfe, Barran, Tolliver, Fleming, Hawkins, Skornik, and Stubbs. Earth and Space Science Laboratory Manual. Boston: D. C. Heath and Company, 1966.

17. The Orbit of Mars (Ex. 28, p. 95)
18. The Sun's Rotation (Ex. 29, p. 99)
19. Eratosthenes' Exercise (Ex. 30, p. 103)
20. The Ecliptic: Who's Moving (Ex. 31, p. 107)
21. Lenses and Telescopes (Ex. 32, p. 111)
22. An Eclipse of the Moon (Ex. 33, p. 115)
23. Binary Stars (Ex. 34, p. 119)
24. Size and Distance (Ex. 35, p. 123)
25. A Model Solar System (Ex. 36, p. 127)

Engelbrektson, Sune and Greenleaf, Peter. Let's Explore Outer Space. New York: Sentinel Books Publishers, Inc., 1969.

26. How to Find the Diameter of the Sun (p. 77)
27. Comparing the Earth and the Moon (p. 47)
28. How to Measure the Diameter of the Moon (p. 47)
29. How to Measure the Size of the Moon in the Sky (p. 48)
30. How to Form Your Own Moon Surface (p. 67)
31. How to Trace the Moon's Orbit around the Earth (p. 39)
32. How to Build a Sighting Apparatus and a Radial Chart to Plot the Moon's Orbit. (p. 41)
33. Observing the Rotation of the Moon on Its Axis as Viewed from Outer Space. (p. 51)
34. Plotting the Moon's Orbit around the Sun. (p. 44)

DEMONSTRATIONS

1. A specially constructed globe, if available, may be used to demonstrate precession of the equinoxes and nutation effects. Otherwise, a toy gyroscope may be used to show precession, but the precession will be in the opposite direction to the precession of the earth.

2. The oblateness of the earth can be illustrated by rotating a "centrifugal" hoop and noting the oblate feature as the hoop gains speed.

3. Illustrate with diagram the motions of the planets. The teacher can illustrate a simulated orbital motion by using a steel ball bearing and a magnet.

4. Demonstrate sun's spectrum with a prism.

5. A "slinky" might be useful in demonstrating wave characteristics.

6. A diagram of total electromagnetic spectrum will demonstrate that visible light comprises only one out of the six octaves.

PROJECTS

1. Make a model planetarium.

2. Make a detailed study of the planets.

3. Make a topographical map of the moon.

4. Keep a two month record of tides at a given place.

5. Observe the relationship of tidal range to moon phases.

6. Make a sun dial and describe to the class how it works.

7. Make a model of the earth at the solstices and equinoxes.

8. Find out dates and locations of meteorites that have hit the earth.

9. Find out everything possible about comets.

10. Observe the size and position of sun spots for several days and note the direction of the sun's rotation and the lack of spots at the poles.

11. Find out dates of meteor showers and observe some.

12. Construct a spectroscope.

13. Find out how the Doppler shift is used by astronomers.

14. Find out how a camera may be used to measure the moon's orbital speed.

15. Using a star chart, plot the orbits of some of the planets.

16. Build a transit and describe to the class how it is used.

FIELD TRIPS

1. Museum of Science Planetarium

2. Southern Cross Observatory
   Museum of Science

3. Cape Kennedy

SPEAKERS

1. Jack Horkheimer - Director of Planetarium Education at the Museum of Science. 854-4242

2. Rolando Millas - Palnetarium director. 854-4242

3. Erik Simonsen - Planetarium narrator. 854-4242.

4. Faculty - Department of Aerospace, University of Miami.

DADE COUNTY 16mm FILMS

1. Asteroids, Comets and Meteorites
   AV#1-01588, 11 minutes, C

2. Earth in Motion
   AV#1-01607, 11 minutes, BW

3. The Earth: Our Planet
   AV#1-10624, 19 minutes, BW

4. Exploring the Moon
   AV#1-10639, 16 minutes, C

5. Exploring the Universe
   AV#1-01516, 11 minutes, BW

FILMS (CONT'D)

6. The Flaming Sky
AV#1-30324, 29 minutes, C

7. How We Know the Earth Moves
AV#1-01631, 11 minutes, C

8. Mars and Beyond
AV#1-30213, 30 minutes, C

9. The Moon and How It Affects Us
AV#1-01575, 11 minutes, C and BW

10. The Moon
AV#1-1570, 11 minutes BW

11. Mystery of the Sun
AV#1-30220, 26 minutes, BW

12. The Nearest Star
AV#1-30217, 29 minutes, C

13. Our Mr. Sun (Part I)
AV#1-30622, 33 minutes, C

14. Our Mr. Sun (Part II)
AV#1-30625, 33 minutes, C

15. Portrait of the Sun
AV#1-10648, 18 minutes, C

16. Solar Family
AV#1-01563, 11 minutes BW

17. The Solar System
AV#1-01543, 10 minutes, BW

18. The Sun and How It Affects Us
AV#1-01595, 11 minutes, C

19. The Sun's Family
AV#1-01552, 11 minutes, BW

FILMS (CONT'D

20. This Is the Moon
AV#1-01579, 11 minutes, BW

21. A Trip To the Moon
AV#1-10641, 16 minutes, C

22. What Makes Day and Night
AV#1-01633, 10 minutes, BW

TRANSPARENCIES

1. Astronomy: Time Zones, Date Line,
AV#2-00203, color, 1 static, 1 overlay.

2. Earth Science: Astronomy, Set 1,
AV#2-30000, color, 11 transparencies.

3. Earth Science: Astronomy, Set 2,
AV#2-30146, color, 10 transparencies.

4. The Universe: The Relative Size of the Planets,
AV#2-00174, color, 1 static, 1 overlay

5. The Universe: Revolution

SLIDES

6. Astronomy: Stars and Planets
AV#5-20097, 30 color slides.

7. Sun and Yerkes Observatory,
AV#5-20006, 12 color slides.

MODELS

8. Astronomy, Set 1,
AV#6-00162 C11 (130 p.)

9. Astronomy, Set 2,
AV#6-00163 C9 (39 p.)

10. Celestial Globe,
AV#6-00107, 14" clear plastic globe, with sun pointer, collar base, 6" color globe inside; manual, wax pencil.

11. Footsteps to the Moon
AV#6-00031, photographs mounted on posters; model of moon, selected moon objects.

12. Planetarium, Illuminated.

13. Astrolabe.

14. Space Map.

DISCUSSION QUESTIONS

1. Why can Venus be seen only in the west as an evening star and only in the east as a morning star?

2. How may measurements of an object's weight show the shape of the earth?

3. What changes would be made in our day if the earth rotated east to west at twice its present rate?

4. Why do planets twinkle when they are close to the horizon?

5. What relation is there to the periods of sun spots and to weather and other activities on the earth?

6. Discuss the Foucault pendulum as a proof of the earth's rotation.

REFERENCES

1. Brandwein, Paul, Stollberg, Robert, and Burnett, R. Will. Energy Its Forms and Changes. New Yrok: Harcourt, Brace and World, Inc., 1968.

2. Brinckerhoff, Richard, Gross, Burnett, Watson, Fletcher and Brandwein, Paul F. The Physical World. 2nd ed. New York: Harcourt, Brace and World, Inc., 1963.

3. Cavanaugh, John M. Introduction to Space Age Astronomy. Washington, D.C.: Educational Services, 1960.

4. Davis, Ira; Burnett, John; Cross, E. Wayne; and Johnson, Theodore. Science-Discovery and Progress. New York: Holt, Rinehart and Winston, Inc., 1965.

REFERENCES (CONT'D)

5. Edgeworth, Kenneth E. The Earth, The Planets and The Stars. New York: MacMillan and Co., 1961.

6. Engelbrektson, Sune and Greenleaf, Peter. Let's Explore Outer Space. New York: Sentinel Books Publishers, Inc., 1969.

7. Firsoff, V.A. The Moon. New York: New American Library, 1966.

8. Johnson, Gaylord and Adler, Irving. Discover the Stars. New York: Sentinel, 1962.

9. King, H. C. Exploration of the Universe. New American Library, 1964.

10. Moore, Patrick. The Picture History of Astronomy. New York: Grosset and Dunlap, 1961.

11. Moore, Patrick. The Solar System. New York: Criterion, 1961.

12. Simak, Clifford. The Solar System - Our New Front Yard. New York: St. Martin's Press, 1962.

MASTER SHEET - OUR SOLAR SYSTEM

Objectives	Investigations	Text	References	Films	Slides and Models	Demonstrations	Projects	Transparencies
1	17, 20, 25	1 pp. 107-115 4 pp. 347-362 5 pp. 35-45	4 pp. 327-329 10 pp. 133-158	1, 5, 17,19	1, 13, 15		1, 2, 8, 9, 11, 13, 16	2, 4
2	15, 24	1 pp. 116-117 4 pp. 353-354 5 pp. 46, 47	2 pp. 391-394 4 p. 327 10 pp. 133, 158	16,17 19	1, 15		1, 2	
3	1, 6, 8, 9	1 pp. 128-132 4 pp. 352-357 5 pp. 81-86 6 p. 373	4 p. 327	16,17 19	1, 13	3	15	
4	4, 5, 12	1 pp. 134-136 3 pp. 250-253 4 pp. 365-368 6 pp. 371-374	2 p. 388 4 pp. 350-351 7 pp. 21, 33, 26 9 pp. 141-147 251, 314	5, 8, 16,17, 19				3
5	3, 18 26	1 pp. 80, 84-86 2 pp. 431-434 4 pp. 347-351 5 pp. 49-56	1 pp. 13, 189 2 pp. 378-381 4 pp. 324-325 10 pp. 53-59 6 p. 75 9 pp. 148-183	6, 13, 14,15, 18		4, 5, 6	12	
6		1 pp. 80-82 2 pp. 432-435 4 pp. 347-351 5 pp. 52-56 6 pp. 388-389	1 p. 336 2 pp. 378-381 4 p. 325 10 pp. 20, 53, 57, 167-169 6 pp. 79-81 9 pp. 130, 132 201-203 216, 274 310	6, 12 13,14, 15,18		4, 5, 6	10	
7	7, 13 27	4 pp. 402-405 5 pp. 75-86 6 pp. 380-381	2 p. 385 10 pp. 19-22 24 6 pp. 82-86 9 pp. 12, 60, 91, 142, 153	2,3,7	14	1, 2	6, 7	
8	2, 27, 28, 29, 30	1 pp. 146-149 3 pp. 302-312 4 pp. 386-388 5 pp. 88-92	2 p. 390 4 pp. 327-328 10 pp. 47, 49 62-63 123-125 131 6 pp. 64-66 7 pp. 34-45	4, 20, 21,22			3	
9	10, 31, 32, 33, 34	1 p. 145 4 pp. 390-391 402-405 5 pp. 81-86 94-98	1 pp. 165, 166, 170 2 pp. 385-386 4 pp. 327-329 10 pp. 51-131 6 pp. 48-51 7 pp. 19, 29, 65 9 pp. 35, 57, 142	2, 7, 10,20, 22	1, 13, 15		14	1, 2, 5

MASTER SHEET OUR SOLAR SYSTEM (con't)

Objectives	Investigations	Text	References	Films	Slides and Models	Demonstrations	Projects	Transparencies
10	32, 33	1 pp. 148-149 4 p. 392 5 pp. 97-98	2 p. 386 4 p. 328 10 p. 29 6 pp. 62-64 7 pp. 8-11	9, 10		1		2
11	11, 22	1 pp. 152-153 4 pp. 394-396 5 pp. 107-113	2 p. 386 4 p. 328 10 p. 29 6 pp. 62-64 7 pp. 11	9,10, 11		2		3
12	14, 16	1 pp. 136-138 4 pp. 396-399 5 pp. 101-105 6 pp. 376-377	2 p. 6 4 pp. 348-349 7 pp. 21-23	9,10, 18,20		3	4, 5	3

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

FROM ATMOSPHERE TO SPACE

5311.05
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SCIENCE
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DIVISION OF INSTRUCTION • 1971

FROM ATMOSPHERE TO SPACE

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Written by Gary Garfinkle and Charles Worthington
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Dade County Public Schools
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FROM ATMOSPHERE TO SPACE

COURSE DESCRIPTION

A survey course in which the student will acquire a basic understanding of astronomy, the nature of flight through the atmosphere, space flight and those men and programs associated with man's desire to conquer space.

ENROLLMENT GUIDELINES

An interest in science especially in aircraft, rocketry and space exploration.

STATE ADOPTED TEXTS

1. Brandwein, Paul F.; Stollberg, Robert; and Burnett, R. Will. Energy - Its Forms and Changes. New York: Harcourt, Brace and World, Inc., 1968.

2. Brandwein, Paul F.; Stollberg, Robert; and Burnett, R. Will. Matter - Its Forms and Changes. New York: Harcourt, Brace and World, Inc., 1968.

3. Oxenhorn, Joseph M. and Idelson, Michael N. Pathways in Science: Earth Science 1. New York: Globe Book Co., Inc., 1968.

4. Thurber, Walter A. and Kilburn, Robert E. Exploring Physical Science. Boston: Allyn and Bacon, Inc., 1966.

PERFORMANCE OBJECTIVES

The student will:

1. Given the proper descriptive phrases, distinguish between refracting, reflecting and radio telescopes.

2. Gather data explaining the history and development of the three basic telescopes.

3. Compare the physical features of the moon with those of the earth.

4. Given the proper descriptive phrases, distinguish between each of the planets in our solar system.

5. Describe the characteristics of the atmosphere in terms of pressure.

6. Distinguish between the forces of lift, drag, thrust and weight acting on an aircraft in flight.

7. Differentiate between propeller and jet propulsion systems for airplanes.

8. Discover some of the problems man has solved in attaining supersonic flight.

9. Given several situations of movement, identify and select the most applicable of Newton's three laws.

10. Interpret Kepler's laws of planetary motion.

11. Distinguish between the aerodynamic and physical forces acting on a moving rocket.

12. Given specific conditions of flight, predict the stability or lack of stability of a rocket.

13. Using common, inexpensive items, devise a method of demonstrating the forces acting on a satellite.

14. Propose reasons for continuation or abandonment of plans for future space travel.

COURSE OUTLINE

I. Astronomy

A. The telescope
1. History of its development
2. Basic telescopes

B. Physical features of the earth

C. Physical features of the moon

D. Physical features of the inner planets

E. Physical features of the outer planets

II. Flight in the Atmosphere

A. The atmosphere
1. The troposphere
2. The stratosphere
3. Air pressure

B. Forces acting on an aircraft in flight
1. Lift
2. Drag
3. Thrust
4. Weight

C. Aircraft propulsion systems
1. Propeller
2. Jet engines

D. Supersonic flight

III. Space Flight

A. Newton's laws of motion

B. Kepler's laws

C. Aerodynamics of rocket flight

D. Rocketry

E. Satellites in orbit

IV. Man in Space

A. History of space flight
   1. Chinese
   2. Goddard
   3. V-2 rocket
   4. U. S. space projects

B. Project Apollo

C. Future of space travel

EXPERIMENTS

Brandwein. Energy - Its Forms and Changes.
New York: Harcourt, Brace and World, Inc., 1968.

1. An Apprentice Investigation of a Refracting Telescope (p. 475)
2. An Apprentice Investigation of Image Formation (p. 484)
3. Weighing Air (p. 124)
4. Making a Model Barometer (p. 127)
5. The Pressure of Moving Air (p. 130)
6. How Airplanes Wings Produce Lift (p. 131)
7. How a Reaction Engine Works (p. 269)
8. Measuring the Speed of Sound (p. 371)

Brandwein. The World of Matter-Energy.
New York: Harcourt, Brace and World, Inc., 1964.

9. Three Investigations Concerning Newton's Laws of Motion (pp. 398-9)
10. Jet Propulsion (p. 320)

MacCracken. Scientists Solve Problems. 2nd. Edition.
Atlanta: The L. W. Singer Company, 1966.

11. How Does Newton's Third Law Operate? (p. 283)
12. How Can You See the Effects of Aerodynamic Support? (p. 285)

Oxenhorn. Pathways in Science - Man and Energy in Space.
New York: Globe Book Co., Inc., 1970.

13. How Can We Draw an Ellipse? (p. 84)
14. How Can We Show Hovering? (p. 172)

Brandwein. Matter - Its Forms and Changes.
New York: Harcourt, Brace and World, Inc., 1968.

15. An Apprentice Investigation of a Model of a Satellite in Orbit (p. 139)
16. Making a Mercury Barometer (p. 286)

Davis. Science - Discovery and Progress.
New York: Holt, Rinehart and Winston Inc., 1965.

17. How Does a Rocket Move? (p. 359)
18. How is Thrust Produced by a Propeller? (p. 42)
19. How a Jet Engine Produces Thrust (p. 43)

Brinckerhoff. The Physical World. 2nd Edition.
New York: Harcourt, Brace and World, 1963.

20. Force (p. 448)
21. Inertia (p. 449)
22. Acceleration (p. 449)
23. Action and Reaction (p. 450)

Thurber. Exploring Physical Science.
Boston: Allyn and Bacon, Inc., 1966.

24. Experiments with Unbalanced Pressures (p. 87)
25. The Effect of Slowing-Down Air (p. 100)
26. The Effect of Speeding-Up Air (p. 101)
27. Pressures on Airplane Wings (p. 102)
28. Measuring the Lifting Force (p. 102)
29. Testing Streamlining (p. 105)

Engelbrektson, Sune and Greenleaf, Peter. Let's Explore Outer Space.
New York: Sentinel Books Publishers, Inc., 1969.

30. How to Plot the Planet's Orbits With a Camera (p. 71)
31. How to Plot the Planet's Orbits With the Aid of a Star Chart (p. 72)
32. How to Find the Moon's Orbit in Space (p. 57)
33. How to Find the Orbital Speed of the Moon With a Camera (p. 59)
34. How to Measure the Orbital Speed of the Moon With the Transit (p. 59)
35. How to Experiment with Weightlessness (p. 111)
36. Launching a Balloon "Rocket" (p. 115)
37. How to Launch Your Single Engine Rocket (p. 119)
38. How High Does Your Model Rocket Fly? (p. 121)
39. Comparing the Earth and the Moon (p. 47)
40. How to Measure the Diameter of the Moon (p. 47)
41. How to Measure the Size of the Moon in the Sky (p. 48)
42. How to Measure the Synodic Month (p. 52)
43. How to Form Your Own Moon Surface (p. 67)

PROJECTS

1. Make a model of an astronomical observatory and its telescope and explain how it works.

2. Make models of different kinds of booster rockets now in use to place satellites in orbit.

3. Make a drawing of a spaceship and explain how it is designed to protect the crew in space.

4. Draw the orbital paths of some of the earth satellites now traveling in space.

5. Build and launch a model rocket.

6. Using a camera and a small telescope make photographs of the moon.

7. Look in magazines that have sky charts and locate the nearer planets. Observe them and make a chart showing their movement over a two month period.

8. Prepare a table of the space flights which have been made. Include on the table the date, maximum distance from earth, information obtained and other data.

9. Give examples of each of Newton's Laws of motion in class.

10. Construct a model of a radio telescope.

11. Make scale models of the planets showing their relative distances from the sun.

12. Make a chart comparing the earth to the other planets with respect to size, density, atmosphere, rotation, revolution, etc.

13. Investigate the history of rocketry from the Chinese to Apollo and make drawings or models of the rockets of each major period.

14. Predict the possible outcomes of man's attempt to conquer space.

15. Build and fly a rubber powered or engine powered model airplane.

16. Construct a wind tunnel.

17. Build a model plane with movable controls.

REPORTS

1. The astronomical findings of the International Geophysical Year.
2. Kepler's laws of planetary motion.
3. Requirements for becoming an astronaut.
4. Newton's laws of motion.
5. Retrograde motion of planets.
6. Space travel in the year 2071.
7. Physical features of all of the inner planets.
8. Physical features of all of the outer planets.
9. Involvement of the Chinese in the area of rocketry.
10. Different types of booster rockets used by the U. S. since 1957.
11. Russian involvement in space travel.
12. Astronaut training program.
13. The lives of any of the current or past astronauts.
14. Early aviation pioneers.
15. Different types of jet engines.
16. Problems of high speed flight.

DEMONSTRATIONS

Oxenhorn. Pathways in Science - Man and Energy in Space.
New York: Globe Book Co., Inc., 1970.

1. How Do Concave Mirrors Work in a Telescope? (p. 31)
2. How Can We Show Jet Action? (p. 159)

Davis. Science - Discovery and Progress.
New York: Holt, Rinehart and Winston Inc., 1965.

3. How Does a Rocket Move? (p. 365)
4. What Is an Elliptical Orbit? (p. 365)
5. Demonstrating Bernoulli's Principle (p. 385)

Thurber. Exploring Science Eight. Boston: Allyn and Bacon, Inc., 1966.

6. The Force Reaction on a Propeller (p. 328)
7. How Jet and Rocket Engines Work (p. 329)

SPEAKERS

1. Museum of Science and Planetarium, 3280 South Miami Avenue, Miami.
2. Aerospace Department, Miami-Dade Junior College.
3. Aerospace Department, University of Miami.

FIELD TRIPS

1. The planetarium located at the Dade County Museum of Science.

2. Arrange a full day trip to visit the rocket launching site at Cape Kennedy.

3. Meet the class in the evening to observe some of the more common star patterns and the nearer planets.

4. George T. Baker Aviation School, Miami.

5. Any of the several flying schools in and near Miami.

FILMS

Available from Time Life Films

1. Principles Of Orbit
   13 min. C

2. Energy In Orbit
   13 min. C

3. Orbital Shapes And Paths
   13 min. C

4. Rendezvous
   13 min. C

5. Over The Hill To The Moon
   13 min. C

6. Flight To The Planets
   13 min. C

7. The Earth In Space
   20 min. C

8. Satellites
   20 min. C

Available from Dade County Audiovisual Services

9. Science In Space
   AV#1-30746, 29 min. C

10. The Nearest Star
    AV#1-30217, 25 min. C

11. Satellites: Stepping Stones To Space
    AV#1-11447, 18 min. C

12. Exploring By Satellite
    AV#1-30740, 28 min. C

13. Exploring Space
    AV#1-30737, 25 min. C

14. Exploring The Edge of Space
    AV#1-11444, 19 min. C

FILM LOOPS

Available from Universal Education and Visual Arts

1. Newtons Law of Motion, 4 minutes.
2. Fixed Systems of Orbiting Bodies, 4 minutes.
3. Moving Systems of Orbiting Bodies, 4 minutes.
4. Orbiting Forces in Various Force Fields, 4 minutes.

FILM STRIPS

1. The Space Age, Eye Gate, 9 film strips, TF131
2. Astronomy in the Space Age, Eye Gate, Set, TF207
3. Man Reaches The Moon, Imperial Film Co., B480-1&2
4. Leaving the Moon, Singer Education and Training Products, 484-1
5. Current Events in Space, Singer, 484-2
6. Man in Space, Singer, 484-3
7. Space Travel A.D. 2000, Singer, 484-4
8. The Story of Flight, Coronet, S103
9. How Airplanes Fly, Coronet, S103
10. Aircraft Engines: Pistons and Jets, Coronet, S103
11. How Rockets Work, Coronet, S103
12. How Satellites Stay in Orbit, Coronet, S103
13. Satellites and their Work, Coronet, S103

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11. Moore, Patrick. A Picture History of Astronomy. New York: Grosset and Dunlap, 1961.

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14. Oxenhorn, Joseph M. and Idelson, Michael N. Pathways in Science - Earth Science 3. New York: Globe Book Co., Inc., 1970.

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17. Thurber, Walter A. and Kilburn, Robert E. Exploring Science Eight. Boston: Allyn and Bacon, Inc., 1966.

18. Trejo, Paul E. Space Science. Berkeley: California Book Co. Ltd., 1963.

MASTER SHEET - FROM ATMOSPHERE TO SPACE

Objectives	Texts	References	Experiments	Projects	Reports	Films	Film Loops	Film Strips	Field Trips	Demonstrations
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